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<b>(21) International Application Number:</b> PCT/EP96/03513 <b>(22) International Filing Date:</b> 8 August 1996 (08.08.96) <b>(30) Priority Data:</b> 9516404.2 10 August 1995 (10.08.95) GB <b>(71) Applicant (for all designated States except MG US):</b> CAMELOT SUPERABSORBENTS LIMITED [CA/CA]; #3 1411-25 Avenue N.E., Calgary, Alberta T2E 7L6 (CA). <b>(71) Applicant (for MG only):</b> CAMELOT SUPERABSORBENTS B.V. [NL/NL]; Hengelosestraat 706, Postbus 545, NL-7500 AM Enschede (NL). <b>(72) Inventor; and</b> <b>(75) Inventor/Applicant (for US only):</b> SHIPLEY, Arthur, Roger [GB/GB]; 8 Oakhill Drive, Prestatyn, Clwyd LL19 9PU (GB). <b>(74) Agent:</b> SMAGGASGALE, Gillian, Helen; Mathys & Squire, 100 Grays Inn Road, London WC1X 8AL (GB).		<b>(81) Designated States:</b> AL, AM, AT, AU, AZ, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, HU, IL, IS, JP, KE, KG, KP, KR, KZ, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, TJ, TM, TR, TT, UA, UG, US, UZ, VN, ARIPO patent (KE, LS, MW, SD, SZ, UG), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>
<b>(54) Title:</b> ABSORBENT ARTICLE CONTAINING ABSORBENT AND NON-ABSORBENT FIBERS  <b>(57) Abstract</b>  A water-retention layer is described which is suitable for use in absorbent articles. The water-retention layer comprises a three-dimensional network of non-water-absorbent fibers and water-absorbent fibers. In addition, an absorbent article comprising a water pervious cover sheet, a water impervious backsheet and the multiple layer water-absorbent core is described.		

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## ABSORBENT ARTICLE CONTAINING ABSORBENT AND NON-ABSORBENT FIBERS

5 The present invention relates to absorbent articles. In particular, it relates to articles such as sanitary napkins and pads, incontinence garments and disposable diapers. In addition, the present invention relates to a water-retention layer for an absorbent article.

As used herein, the term "water" when used alone or in the phrases "water-absorbing", "water-absorbent", "water-swellaable" and the like is understood to mean not only water but also aqueous media such as, in particular, electrolyte solutions such as body fluids.

10 Sanitary napkins, pads, incontinence garments and disposable diapers have been known for many years and much effort has been made to improve the functional efficiency of such articles to make them more absorbent, more comfortable to wear and less obtrusive to the wearer.

15 In general, such products have a core which includes a water-absorbent layer. This water-absorbent layer may be formed from any suitable water-absorbent material including wood pulp, rayon and tissue. Additionally or alternatively, the layer may comprise any of the water-absorbing polymer compositions commonly known as superabsorbent polymers.

20 A number of absorbent compositions have been developed which exhibit the capacity to be water-absorbing. Known compositions may be in any suitable form including powders, particles and fibers. US 3,954,721 and US 3,983,095, which are incorporated herein by reference, disclose preparations for derivatives of copolymers of maleic anhydride with at least one vinyl monomer in fibrous form. The fibrous copolymers are rendered hydrophilic and water-swellaable by reaction with ammonia or an alkali metal hydroxide. US 3,810,468, which is incorporated herein by  
25 reference, discloses lightly cross-linked olefin-maleic anhydride copolymers prepared as substantially linear copolymers and then reacted with a diol or a diamine to

introduce cross-linking. The resultant lightly cross-linked copolymers are treated with ammonia or an aqueous or alcohol solution of an alkali metal hydroxide. US 3,980,663, which is incorporated herein by reference, describes water-swella-  
5 ble absorbent articles made from carboxylic polyelectrolytes via cross-linking with glycerine diglycidyl ether.

European Published Application No. 0 268 498 (incorporated herein by reference) describes a water-absorbent composition formed by causing a substantially linear polymer of water-soluble ethylenically unsaturated monomer blends comprising carboxylic and hydroxylic monomers to cross-link internally.

10 Further examples of water-absorbent compositions are those produced from a copolymer of an  $\alpha,\beta$  unsaturated monomer having at least one pendant unit selected from a carboxylic acid group and derivatives thereof and a copolymerisable monomer. A proportion of the pendant units are present in the final copolymer as the free acid and a proportion as the salt of the acid. These copolymers are capable of being  
15 cross-linked, either internally or with a variety of cross-linking agents, to form the water-swella-  
ble composition. Examples of water-swella-  
ble compositions of this type can be found in US 4,616,063, 4,705,773, 4,731,067, 4,743,244, 4,788,237, 4,813,945, 4,880,868 and 4,892,533 and EP 0 272 074, 0 264 208 and 0 436 514 which are incorporated herein by reference.

20 Derivatives of carboxylic acid groups include carboxylic acid salt groups, carboxylic acid amide groups, carboxylic acid imide groups, carboxylic acid anhydride groups and carboxylic acid ester groups.

Other examples of water-absorbent compositions can be found in US 4,798,861, WO 93/17066, WO 93/255735, WO 93/24684, WO 93/12275, European Published  
25 Application Nos 0 401 044, 0 269 393, 0 326 382, 0 227 305, 0 101 253, 0 213 799, 0 232 121, 0 342 919, 0 233 014, 0 268 498 and 0 397 410, British Patent Application Nos 2 082 614, 2 022 505, 2 270 030, 2 269 602 and 2 126 591, US Patent Nos 4,418,163, 4,418,163, 3,989,586, 4,332,917, 4,338,417, 4,420,588 and

4,155,957 and French Patent Application No 2 525 121 which are all incorporated herein by reference.

5 Water-absorbent material of the kinds referred to in the above-mentioned patents and applications may be in any suitable form including powder, particulate granular and fibers; the fibers may be straight or may be curled and/or crimped. Details of such curly/crimped fibers may be found in US 4,822,453, 4,888,453 5,462,793 and 4,898,462 which are incorporated herein by reference. In one alternative material, the water-absorbent polymer may be coated onto the whole or a part of the surface of other materials such as non-water-absorbent fibers. Details of one type of fibers  
10 of this type may be found in WO 96/15307 which is incorporated herein by reference.

Other kinds of water-absorbent materials may be used as, or as part of, the water-absorbing layer. Suitable materials include naturally occurring water-absorbent materials. One such water-absorbent material is starchy material such as that proposed by the US Department of Agriculture in 1969-1970. Peat moss may also  
15 be used a water-absorbent material. In this connection, reference may be made to US 5,477,627 5,429,242 5,374,260 4,992,324 4,676,871 4,573,988 4,560,372 4,540,454 4,537,590 and 4,226,237 which are incorporated herein by reference. Alginates have also been proposed as suitable water-absorbent material. One example of the use of such alginates is that suggested by Beghin/Kayserberg.

20 The water-absorbent layer may be of non-uniform configuration. For example, where the absorbent article is a feminine hygiene product or a diaper, the water-absorbent layer may be shaped such that it is thicker in the crotch region.

Whatever material is used for the absorbent layer, it is generally backed by a water-impervious backing sheet to protect clothing from soiling and to prevent leakage of the body fluid which would cause embarrassment to the user. Any water-impervious  
25 backing sheet may be used.

The article generally has a water-permeable non-woven type cover sheet which

defines the surface of the article which will, in use, be in contact with the user. The cover sheet is intended to insulate the wearer from contact with water that has been absorbed into the water-absorbent layer of the core, thus the cover sheet should allow water to pass through it into the core but remain dry and soft to the touch. Any suitable material may be used as the cover sheet. One example of a suitable cover sheet is described in US 5,257,982 which is incorporated herein by reference.

As there is often a discharge of a substantial volume of water in a short time, the core may additionally include a distribution layer which is generally located above the water-absorbent layer. The distribution layer serves to wick the water away from the point of initial contact with the article and transport it to other parts of the water-absorbent layer. The use of a distribution layer of this type is advantageous in addressing the problem of pooling if a substantial volume of water is discharged in a short time and thereby gives a feeling of dryness. Examples of distribution layers include those described in EP 0 565 606, GB 2 266 465 and GB 2 278 371 which are incorporated herein by reference.

Whilst the use of distribution layers of this type go some way to reducing the effects of pooling, they do not satisfactorily overcome the problem of rewet once the water has been absorbed into the water-absorbent layer. Rewet is a measure of how dry the articles feel to the touch after water-absorption. This is generally measured under a load of approximately 3 - 5 kPa. Rewet is of particular importance in the applications to which the absorbent articles of the present invention are directed because if the article feels damp the user will feel damp and uncomfortable.

The problem of rewet is particularly acute where the water-absorbent layer is formed from or includes the water-absorbent polymers described above, in particular from the fast absorbing water-absorbent fibers. Although the water-absorbent polymers described above, can absorb a large volume of water and absorption can take place in a short time, in some circumstances, the water-absorbent polymer may become locally saturated because of the fast absorbency of the water-absorbent and may therefore feel damp to the touch.

One solution to the aforementioned problems is described in our co-pending United Kingdom patent application no 9508541.1 in which a multiple layer water-absorbent core suitable for use in an absorbent article is described. The multiple layer absorbent core comprises a water-absorbent layer and a non-water-absorbent spacer layer located above the water-absorbent layer. The spacer layer is preferably thick, has high resilience or is both thick and has high resilience.

We have now discovered that alternative means of overcoming the aforementioned problems may be provided if the non-water-absorbent spacer layer of application no 9508541.1 is replaced with a water-retention layer which allows water to pass into the water-absorbent layer but prevents the water from returning to the uppermost surface where it may come into contact with the cover sheet. This is achieved by using a three dimensional network of non-water-absorbent fibers and water-absorbent fibers.

Thus according to the first aspect of the present invention there is provided a water-retention layer suitable for use in an absorbent article comprising a three-dimensional network of non-water-absorbent fibers and water-absorbent fibers.

According to a second aspect of the present invention there is provided a multiple layer water-absorbent core suitable for use in an absorbent article comprising a water-absorbent layer and a water-retention layer in accordance with the first aspect of the present invention located above the water-absorbent layer.

By "non-water-absorbent" we mean that the fibers do not absorb to an appreciable extent. Suitable materials from which the non-woven material may be formed include natural or synthetic fibers such as cellulose, viscose, polyester, non-water-absorbent polymers of propylene, polyamide and ethylene-propylene copolymer fibers, and mixtures thereof and the like, with polyester, polyethylene and polypropylene fibers being particularly preferred. Outer suitable fibers include rayon fibers, cellulose ester fibers, protein fibers, polyamide fibers, polyester fibers, polyvinyl fibers, polyolefin fibers, polyurethane fibers, aramid fibers, glass fibers and mixtures thereof. Fibers

having a hollow core, such as the polyester, typically polyester terephthalate, fibers commercially available from E.I. DuPont de Nemours under the trade name HOLLOWFILL. Bicomponent fibers may also be used.

5 The non-water-absorbent fibers may be hydrophobic or hydrophillic, though hydrophobic fibers are preferred. The non-water-absorbent fibers may be a mixture of hydrophobic and hydrophillic fibers. Without wishing to be bound by any theory, it is believed that an improved layer is provided if some hydrophillic fiber is present to act as an initial absorber as the water floods into the water-retention layer under pressure.

10 The fibers whether water-absorbent or non-water-absorbent preferably have a crimped profile. Crimping serves to improve the ability of the fibers to reduce rewet. The fibers may have a cut length of from 6 to 80 mm. The fibers may additionally or alternatively have a curled profile.

15 In a particularly preferred embodiment, the water-retention layer preferably comprises 20 to 90%, 7 denier per filament (dpf) from 6 to 60 mm synthetic and/or natural fiber and 80 to 10%, 10 dpf from 6 to 60 mm absorbent fiber. 7 dpf and 10 dpf are typical fiber sizes. It will be understood that any suitable fiber size may be used. The size of fiber chosen may be dictated by the requirements of the web technology used to construct the fiber web.

20 Without wishing to be bound by any theory it is believed that as water is applied to the absorbent article it passes through the cover sheet to the water-retention layer. The water will pass in a concentrated stream through the network of fibers of the water-retention layer into the absorbent core with the minimum of activation of the water-absorbent fibers in the water-retention layer. The return of water from the  
25 absorbent core to the cover sheet is prevented as the returning water is absorbed by the water-absorbent fibers in the water-retention layer.

The network of fibers of the water-retention layer is preferably constructed such that

it includes voids to allow for the expansion of the water-absorbent fibers. The amount of open space within the retention layer is preferably proportional to the amount of water-absorbent fiber present. The void space is preferably filled when the water-absorbent fiber has attained about 80% of its free swell volume. When this  
5 has occurred, the retention layer has a dry feel.

The water-retention layer may be formed by any suitable means. The layer may be formed from individual fibers or may be a non-woven or woven mat of fibers. The fibers in the mat may be bonded. The fibers are preferably air laid and bonded using a sprayable adhesive such as a hot-melt adhesive. The fibers may be thermobonded  
10 or bonded by means of any suitable bonding technique. Where the fibers are to be thermobonded, low melting bonding fibers may be included. An example of a low melting bonding fiber is a fiber having a high temperature polypropylene core with a low temperature outer sheath: the fiber being spun as a bicomponent fiber.

The water-retention layer is preferably bonded to the water-absorbent core to form a multi-layer core. Bonding is preferably achieved using a spray adhesive such as hot  
15 melt adhesive based on styrene butadiene rubbers. However, other means of bonding the water-retention layer to the absorbent core may be used, for example, fiber entanglement.

The adhesive may be applied such that it is discontinuous, i.e. spaces are located  
20 between nodules of adhesive.

The multilayer core formed by bonding the water-retention layer to the water-absorbent core may be used in the production of an absorbent article. Thus in accordance with a third aspect of the present invention there is provided an absorbent article comprising a water-pervious cover sheet, a water-impervious backsheet and a  
25 multiple layer water-absorbent core according to the above second aspect of the present invention, wherein the cover sheet is joined to the backsheet to enclose the water-absorbent core.



An absorbent article in accordance with a preferred embodiment of the present invention will now be described with reference to the following example.

### Example

5 The cover sheet of a commercial diaper was opened and a water-retention layer was attached to the upper surface of the absorbent core by lightly bonding with a spray adhesive. The absorbent core of the diaper contained approximately 20% granular water-absorbent material available from Camelot Superabsorbents Limited as a percentage of absorbent core weight.

10 Three doses of 50ml of a 1% saline solution was injected through the top surface of the diaper. The water was administered from a polyethylene beaker having a base diameter of 80mm; the centre of which had a 3 mm diameter hole. The beaker simulated natural fluid emission. The 80 mm base simulated the area of pressure exerted by a baby. A 200 ml beaker was preferably used. A dwelling time of 10 minutes was allowed between saline injections and the commencement of the measurement of rewet.

15 One method of measuring rewet is by adding saline solution to the absorbent article. After 10 minutes, 10 preweighed Whatman™ #3 filter papers (dry weight W1) are placed on top of the composite pad and a 2kg load is applied for 2 minutes. The filter papers are then removed and reweighed (wet weight W2). Rewet can then be calculated according to the following formula:

$$\text{Rewet} = W1 - W2.$$

Rewet of the modified diaper was measured in this way. No water return was noted with the modified diaper. However, with an unmodified diaper a rewet of 0.15g saline was noted.

25 During the test it was also noted that the rate of saline uptake was approximately a third faster when the water-retention layer was present when compared to the diaper

without the water-retention layer.

Whilst the adhesive article has been described as including a cover sheet, it will be understood that with the arrangement of the present invention, the cover sheet may be omitted.

5      Whilst the present invention has been described with reference to sanitary napkins and pads, incontinence garments and disposable diapers it will be understood that the invention is equally applicable to other products which require high water-absorption capability such as pant liners, training pads, tampons, adult incontinence pads, bandages, patient underpads (for example pads of the type described in US 3,814,101  
10      US 4,342,314 and EP 0 052 403 which are incorporated herein by reference), mortuary pads, casket liners, forensic examination pads, meat trays, soaker pads for food use, medical tray pads, fenestration drapes, other medical related articles, seed germination pads, capillary mats, baby bibs, desiccant strips for anti-rust use, bath mats, packaging, sorbents, clothing, breast pads, underarm pads, surgical and dental  
15      sponges, bandages, industrial wipes, domestic wipes, wipes, filters, cable wrap, food preservation articles, roofing materials, automotive trim, furniture, gasket, sealants, pond liners, bedding, clothing, cement, household pet litter, soil modifiers, wound covers and the like.

CLAIMS:

1. A water-retention layer suitable for use in an absorbent article comprising a three-dimensional network of non-water-absorbent fibers and water-absorbent fibers.
- 5 2. A water-retention layer according to Claim 1 wherein the non-water-absorbent fibers are fibers of cellulose, viscose, polyester, non-water-absorbent polymers of ethylene, non-water-absorbent polymers of propylene, polyamide and ethylene-propylene.
- 10 3. A water-retention layer according to Claim 1 or 2 wherein the fibers are crimped.
4. A water-retention layer according to any one of Claims 1 to 3 wherein the fibers have a cut length of from 6 to 80 mm.
- 15 5. A multiple layer water-absorbent core suitable for use in an absorbent article comprising a water-absorbent layer and a water-retention layer in accordance with any one of Claims 1 to 4 located above the water-absorbent layer.
6. A multiple layer water-absorbent core according to Claim 5 wherein the water-absorbent layer of the core includes a water-absorbent polymeric composition.
- 20 7. A multiple layer water-absorbent core according to Claim 6 wherein the water-absorbent polymeric composition is in the form of fibers.
8. An absorbent article comprising a water pervious cover sheet, a water impervious backsheet and a multiple layer water-absorbent core as claimed in any one of Claims 5 to 7, wherein the cover sheet is joined to the backsheet to enclose the water-absorbent core.

# INTERNATIONAL SEARCH REPORT

International Application No.

PCT/EP 96/03513

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A61F13/15

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A61F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO,A,95 13776 (PROCTER & GAMBLE) 26 May 1995 see page 11, paragraph 2 - page 12, paragraph 3	1-8
X	--- EP,A,0 395 223 (AMERICAN COLLOID CO) 31 October 1990 see column 11, line 11 - column 12, line 14	1,2,5-8
X	--- EP,A,0 306 262 (PROCTER & GAMBLE) 8 March 1989 see page 2, line 59 - page 3, line 8 see page 4, paragraph 56 - page 5, paragraph 17 --- -/-	1-4

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Intern. Patent Application No.  
PCT/EP 96/03513

## Continuation DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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# INTERNATIONAL SEARCH REPORT

Information on patent family members

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PCT/EP 96/03513

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